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ABSTRACT

In 1988-89 the Connecticut Vocational-Technical School System initiated a program for the ongoing review and upgrading of all trade and academic curricula used in the system's 17 schools to insure that each curriculum is consistent with current standards. Every 3 years the Curriculum Steering Committee for the trade or academic subject conducts a review and an analysis to identify outdated content, approaches, or materials. The revised curriculum incorporates the latest thinking of instructors who teach the subject, suggestions from authorities in the mathematics field, and current instructional approaches in the field of education. This curriculum is intended as a plan for learning algebra and as an aid to the mathematics instructor to prepare students for membership in society. The document is separated into several sections: the Vocational-Technical School Mathematics Sequence; Career Relationships and Requirements; Instructor's Goals; Students' General Competencies; a Common Core of Learning; Personal Goals for Students; and a series of 10 algebra units. Each unit provides suggested instructional time, unit objectives, and a list of student competencies required of students after completing the unit. The units are: (1) Signed Numbers and Order of Operations; (2) Evaluation of Algebraic Expressions; (3) Equations in One Variable; (4) Fractional Parts of Numbers; (5) Inequalities and More about Exponents; (6) Multivariable Equations and Additions of Fractional Equations; (7) Percents and Polynomials; (8) Graphs of Linear Equations; (9) Rational Expressions, Exponents, Substitution Axiom, Complex Fractions, and More Graphing; (10) Substitution, Subsets, Square Roots, Domain, and Additive Property of Inequality. Computer Software and a textbook are recommended. (MDH)

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ALGEBRA

VOCATIONAL-TECHNICAL SCHOOL SYSTEM
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ALGEBRA
CURRICULUM

PREPARED BY EASTCONN
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PREPARED FOR:

CONNECTICUT STATE DEPARTMENT OF EDUCATION
DIVISION OF VOCATIONAL, TECHNICAL AND ADULT EDUCATION
VOCATIONAL-TECHNICAL SCHOOL SYSTEM
MIDDLETOWN, CONNECTICUT

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1989

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Course Outline:

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FOREWORD

In 1988-89 the Connecticut Vocational-Technical School System initiated a program for the ongoing review and upgrading of all trade and academic curricula used in the System's seventeen schools to insure that each curriculum is consistent with current standards. Each curriculum is first reviewed by the appropriate Curriculum Steering Committee. That is done during the third year following the curriculum's last revision. The Curriculum Steering Committee for the trade or academic subject conducts a review and an analysis to identify outdated content, approaches, or materials. Any deficiencies are noted. During the following year a sub-committee of the Steering Committee prepares a revision of the curriculum incorporating all required changes.

This publication is the result of such a revision. The curriculum incorporates (a) the very latest thinking of instructors who teach the subject, (b) suggestions from authorities in the mathematics field, and (c) current instructional approaches in the field of education.

Special appreciation is extended to the instructors who provided input prior to the beginning of the curriculum revision. We also appreciate the suggestions and significant contribution of Ronald E. Brann, Consultant, Connecticut State Department of Education, Vocational, Technical & Adult Education, Vocational-Technical School System.

Jerry C. Bencivenga, Consultant
Vocational-Technical School System

John Bruno, Steering Committee Chairman
August 1989

INTRODUCTION

The following curriculum is intended as a plan for learning and an aid to the instructor whose responsibility it is to teach mathematics and to prepare students for involved and productive membership in society. The curriculum document consists of several sections. Each of the sections is explained below.

Career Relationships and Requirements. The instructor is the key person in the student's preparation for adult society. This section of the curriculum reminds the Instructor of some career related informational sources which should be shared with the students.

Common Core of Learning (CCL). Each of the General and Personal Goals for Students directly relates to a component of Connecticut's Common Core of Learning. However, the instruction and experiences which are provided to assist a student toward achievement of a competency may address other CCL components in varying degrees. The CCL Matrix illustrates the full range of CCL components which are effected. Instructors should refer to the complete list of CCL components found in the Appendices.

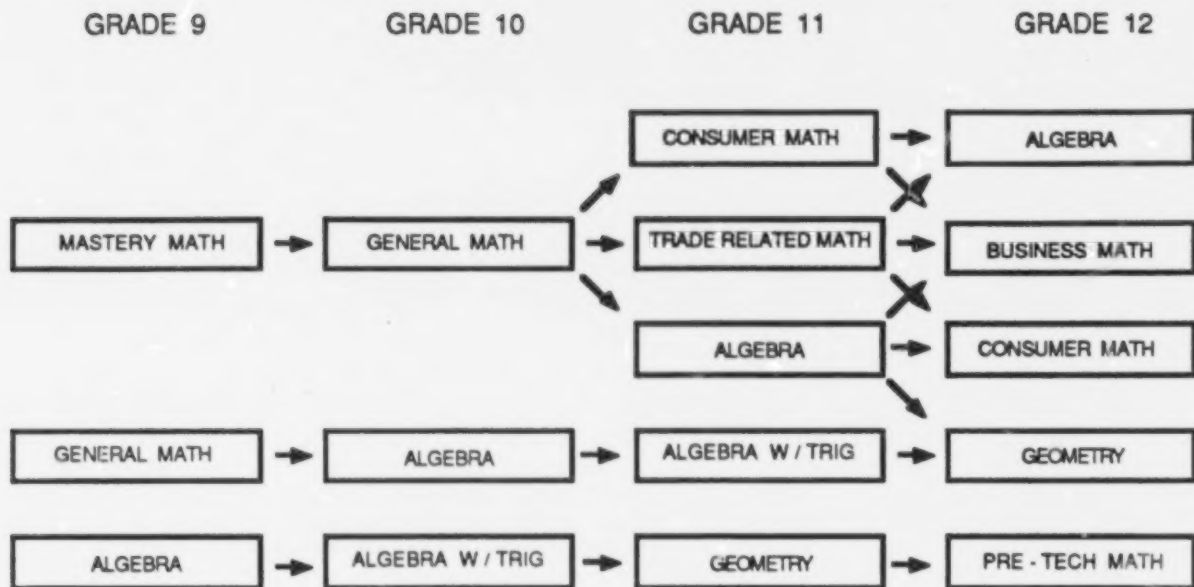
Instructor's Goals. These are the competencies expected of every successful student in the program. Competencies are stated in terms of expected student outcomes. All subsequent instructional decisions should show a relationship to one or more of these competencies.

Personal Goals for Students. A successful citizen and tradesperson becomes such through the mastery of essential knowledge and skills plus the internalization of positive attitudes and values. "Personal Goals for Students" calls attention to some behaviors which should be demonstrated by responsible citizens.

Course Outline. Course content, specific objectives, and related activities are organized into coherent blocks of instruction. They may be called units or they may simply be identified by a designated period of time. Contained within each block are the differentiated Student Competencies and an outline of the essential content necessary for achievement of them. The units contain suggested activities and suggested approaches to assessment. In all cases, they are suggestions not prescriptions. The instructor is expected to commit to the goals and competencies but alternative means may be employed to achieve them.

Appendices. The appendices offer brief lists of resources appropriate to the successful completion of the program. In addition to the obvious use of these pages, the instructor may refer to the appendices when ordering supplies.

VTSS
MATHEMATICS SEQUENCE



All voc-tech schools should schedule math students by ability. When students need to learn a new math skill out of sequence for use in their shop, the shop instructor should teach it during theory.

We encourage our students to challenge themselves with advanced course work to stretch the limits of their ability and not just accept minimum achievement as a goal.

In addition, scheduled computer-assisted math is available in all schools to tutor students in need.

Finally, students should not be tracked in any one sequence. Any students showing success in a mathematics course should be considered for advanced courses. For this reason, classes are not limited to a single grade.

3-17-89

CAREER RELATIONSHIPS AND REQUIREMENTS

Successful completion of this course provides a student with the basic understanding of the math skills needed to enhance their career. He or she should also have an understanding and appreciation of the vital role of mathematics in everyday transactions. Through this knowledge the student will be able to benefit as a worker, consumer or business person, and be a more productive citizen. The mathematical principles constitute a foundation which the student can continue to learn and add to his/her individual knowledge. Students who wish to consider career options in mathematics should be encouraged to consult the Connecticut Information System (COIS) and the Occupational Outlook Handbook (United States Department of Labor) to identify related occupations and their requirements.

INSTRUCTOR'S GOALS

The Instructor will:

1. Plan learning experiences which consist of a logical introduction, sufficient development and guided practice for basic understanding and a summarizing conclusion.
2. Select delivery strategies which take into account the different interests, abilities, learning styles, and expectations of Vocational-Technical School students;
3. Plan and present lessons that demonstrate how mathematics relates to the student's selected trade area.
4. Plan instruction geared to ability levels of the students in each class.
5. Employ a variety of instructional techniques.
6. Use a variety of evaluative tools and techniques.
7. Encourage students to use their creativity and initiative.
8. Present learning experiences in such a way as to elicit higher-level thinking and critical thinking;

STUDENTS' GENERAL COMPETENCIES

The Student will:

1. Use the rules for addition, subtraction, multiplication, and division of signed numbers.
2. Add, subtract, multiply and divide algebraic expressions.
3. Solve equations.
4. Use the rules of algebra to solve stated word problems.
5. Factor algebraic expressions.
6. Add, subtract, multiply, and divide algebraic fractions.
7. Solve fractional equations.
8. Find solutions to systems of equations.
9. Graph straight lines.
10. Raise algebraic expressions to stated powers.
11. Find roots of numbers and algebraic expressions or simplify if root cannot be found.
12. Perform computations using exponents.
13. Find the root(s) of an equation.
14. Solve inequalities.
15. Understand how mathematics relates to the student's selected vocation or trade area.

**CORRELATIONS OF TRADE/SUBJECT COMPETENCIES
WITH CONNECTICUT'S COMMON CORE OF LEARNING**

LIST OF STUDENT COMPETENCIES OR ANTICIPATED OUTCOMES	RELATED COMMON CORE OF LEARNING COMPONENTS		
TRADE/SUBJECT: ALGEBRA	ATTITUDES AND ATTRIBUTES	SKILLS AND COMPETENCIES	UNDERSTANDINGS AND APTITUDES
Be able to use the rules of addition, subtraction, multiplication, and division of signed numbers.		D1	F7
Be able to add, subtract, multiply and divide algebraic expressions.			F7
Be able to solve equations.		E6,E7, E8,E9	F1, F2
Be able to use the rules of algebra to solve stated word problems.		D4	F2, F4, F7
Be able to factor algebraic expressions.		E5	
Be able to add, subtract, multiply, and divide algebraic fractions.		D1	
Be able to solve fractional equations.			F1, F7
Be able to graph straight lines.		D7	
Be able to raise algebraic expressions to stated powers.		D3	
Be able to find roots of numbers and algebraic expressions or simplify if root cannot be found.	D1	D3	
Be able to perform computations using exponents.		D3	
Be able to find the root(s) of an equation.		D3	
Be able to solve inequalities.		D5	F1, F7
Understand how mathematics relates to the student's selected vocation or trade area.	A3, D3	F1	B3,B4,B5, B6,F2,F3

PERSONAL GOALS FOR STUDENTS.

The Student will demonstrate a willingness to:

1. Do assigned tasks without constant supervision.
2. Work as a team member and assist others.
3. Observe safety rules.
4. Maintain books, equipment and/or work stations.
5. Contribute to maintaining a positive educational environment within the classroom.

UNIT I

SIGNED NUMBERS AND ORDER OF OPERATIONS

Suggested Instructional Time: 15 days

Unit Objective: After completion of this unit, the student should understand all uses of signed numbers. The student should know the correct order of operations when using these numbers.

Student Competencies:

After completing this unit, all students should be able to:

1. Recognize, read and write numerals naming positive and negative numbers.
2. Draw a number line and locate given points.
3. Correctly specify given sets by roster method.
4. Determine the absolute value of a number.
5. Add signed numbers on the number line using vectors.
6. Add integers and rational numbers.
7. Determine the opposite or additive inverse of a number.
8. Multiply and divide integers and rational numbers.
9. Simplify numerical expressions that contain symbols of inclusion and know the correct order of operations.

UNIT II

EVALUATION OF ALGEBRAIC EXPRESSIONS

Suggested Instructional Time: 10 days

Unit Objective: After completion of this unit, the student should be able to evaluate all types of algebraic expressions.

Student Competencies:

After completing this unit, all students should be able to:

1. Evaluate simple expressions using positive and negative numbers.
2. Evaluate expressions using parentheses and positive and negative numbers.
3. Evaluate expressions using the distributive property.
4. Add like terms.
5. Evaluate expressions with exponents.
6. Apply the product theorem for exponents.

UNIT III

EQUATIONS IN ONE VARIABLE

Suggested Instructional Time: 8 days

Unit Objective: After completion of this unit, the student should develop an understanding of the vocabulary used with equations and their solutions. The student should be able to solve equations by the additive property of equality and the multiplicative property of equality. The student should be able to solve all simple equations including decimal equations.

Student Competencies:

After completing this unit, all students should be able to:

1. Solve conditional equations.
2. Solve equations using the additive property of equality.
3. Solve equations using the multiplicative property of equality.
4. Solve equations using both the additive property of equality and the multiplicative property of equality.
5. Solve more complicated equations with variables on both sides of the equation.
6. Solve equations which have decimals on one or both sides.

UNIT IV

FRACTIONAL PARTS OF NUMBERS

Suggested Instructional Time: 12 days

Unit Objective: After completion of this unit, the student should understand the fundamentals of fractions.

Student Competencies:

After completing this unit, all students should be able to:

1. Find the fractional parts of numbers.
2. Work with negative exponents.
3. Work with zero exponents and determine decimal parts of a number.
4. Write algebraic phrases that correspond to word phrases.
5. Solve equations using parentheses.
6. Solve word problems that contain only one statement of equality.
7. Solve word problems that contain a statement about quantities that differ by a specified amount.
8. Write numbers as products of prime factors.
9. Determine the greatest common factor of two or more terms.
10. Factor the greatest common factor of two or more terms.
11. Cancel when the numerator and the denominator contain one or more common factors.
12. Work with expressions that contain both minus signs and negative exponents.

UNIT V

INEQUALITIES AND MORE ABOUT EXPONENTS

Suggested Instructional Time: 8 days

Unit Objective: After completion of this unit, the student should be able to graph inequalities, solve proportions involving an unknown, understand the Quotient Theorem for exponents, use the distributive property to expand expressions that contain fractions and negative exponents, and to rewrite each term so that all exponents are positive.

Student Competencies:

After completing this unit, all students should be able to:

1. Use the number line to display the graph of the solution to many inequalities.
2. Solve proportions that contain an unknown by setting the cross products equal and then dividing to complete the solution.
3. Understand the Trichotomy Axiom and that symbols of inequality can be negated by drawing a slash through the symbol.
4. Apply the Quotient Theorem For Exponents: If m and n are real numbers and $x \neq 0$, and
5. Use the distributive property to expand expressions that contain fractions and negative exponents.
6. Determine if terms in an expression are like terms by rewriting each term so that all exponents are positive.

UNIT VI

MULTIVARIABLE EQUATIONS AND ADDITIONS OF FRACTIONAL EQUATIONS

Suggested Instructional Time: 8 days

Unit Objective: After completion of this unit, the student should be able to solve multivariable equations, find the least common multiple of algebraic expressions, add rational expressions, add abstract fractions, and use inequality signs to describe a statement of two conditions.

Student Competencies:

After completing this unit, all students should be able to:

1. Solve multivariable equations by rearranging the equation so that the designated variable is the sole member of one side of the equation.
2. Find the smallest number that is evenly divisible by each of the given numbers.
3. Find the algebraic least common multiple of algebraic expressions.
4. Add fractions with equal denominators by adding the numerators algebraically and recording the sum over a single denominator.
5. Apply the rule that the denominator and numerator of a fraction can be multiplied by the same non-zero quantity. Use this rule when adding abstract fractions.
6. Use notation to describe an algebraic inequality involving two conditions.

UNIT VII
PERCENTS AND POLYNOMIALS

Suggested Instructional Time: 7 days

Unit Objective: After completion of this unit, the student should be able to solve all types of percentage problems and add and multiply polynomials.

Student Competencies:

After completing this unit, all students should be able to:

1. Solve word problems about percent less than 100.
2. Add monomials and polynomials.
3. Multiply monomials and polynomials.
4. Solve word problems about percent greater than 100.

UNIT VIII

GRAPHS OF LINEAR EQUATIONS

Suggested Instructional Time: 6 days

Unit Objective: After completion of this unit, the student should be able to graph linear equations.

Student Competencies:

After completing this unit, the student should be able to:

1. Graph the ordered pairs of X and Y on a rectangular coordinate system.
2. Graph a linear equation.
3. Graph vertical and horizontal lines.

UNIT IX

RATIONAL EXPRESSIONS, EXPONENTS, SUBSTITUTION AXIOM, COMPLEX FRACTIONS, AND MORE GRAPHING

Suggested Instructional Time: 7 days

Unit Objective: After completion of these units, the student should be able to add rational expressions, apply the power theorem for exponents, solve simultaneous equations by substitution, divide complex fractions, understand set notation, and rearrange an equation before graphing.

Student Competencies:

After completing this unit, all student should be able to:

1. Add rational expressions.
2. Apply the power theorem for exponents, i.e., $(x^m)^n = x^{mn}$
3. Solve simultaneous equations by substitution.
4. Divide one fraction by another fraction, invert the fraction in the denominator and multiply.
5. Understand the terms finite and infinite.
6. Solve linear equations for Y in order to graph these equations.

UNIT X

SUBSTITUTION, SUBSETS, SQUARE ROOTS, DOMAIN, AND ADDITIVE PROPERTY OF INEQUALITY

Suggested Instructional Time: 9 days

Unit Objective: After completion of this unit, the student should be able to rearrange simultaneous equations before solving through substitution, know the subsets of the set of real numbers, find the roots of a positive real number, apply the product of square roots theorem, understand the word domain, and apply the additive property of inequality.

Student Competencies:

After completing this unit, all students should be able to:

1. Rearrange an equation so that Y is written in terms of X.
2. Define the sets: naturals, wholes, integers, rationals, and reals.
3. Know: If X is greater than Zero, then —
4. Find an approximation for the square root of a positive real number.
5. Simply the square root of any product by writing the number as a product of prime factors.
6. Understand and apply the terms: domain, replacement values.
7. Apply the additive property of inequality.

APPENDIX A
COMPUTER RESOURCE SOFTWARE

<u>Item</u>	<u>Software</u>	<u>Computer</u>
1.	Math Blaster	Mac
2.	Math Blaster Plus	Apple IIGS/IIf
3.	Algablaster	Apple IIGS
4.	Simple Accounting	Mac
5.	Math Talk	Mac
6.	Jumping Math Flash	Apple IIGS
7.	Math Type	Mac
8.	MacDraft	Mac
9.	Pict-O-Graph	Mac
10.	Geometry	Mac
11.	Calculus	Mac
12.	Problem Solving in Algebra Intro and Lessons 1 - 7	Apple II GS/IIf
13.	Problem Solving in Algebra Lessons 8 - 14	Apple II GS/IIf
14.	Problem Solving in Algebra Lessons 15 - 21	Apple II GS/IIf
15.	Problem Solving in Algebra Lessons 22 - 30	Apple II GS/IIf
16.	Problem in Algebra Lessons 31 - 38	Apple II GS/IIf
17.	Geometry - Funky Chicken	Apple II GS/IIf
18.	Geometry - Exploring Triangles	Apple II GS/IIf
19.	Estimation - Estimation Invasion	Apple II GS/IIf
20.	Estimation - Round up, Round down	Apple II GS/IIf
21.	Math Skills - Junior High Level	Apple II GS/IIf
22.	Math Skills - Elementry Level	Apple II GS/IIf

APPENDIX B
RECOMMENDED TEXTBOOKS

John H. Saxon, Jr. Algebra I, An Incremental Development. Norman Oklahoma:
Saxon 1989